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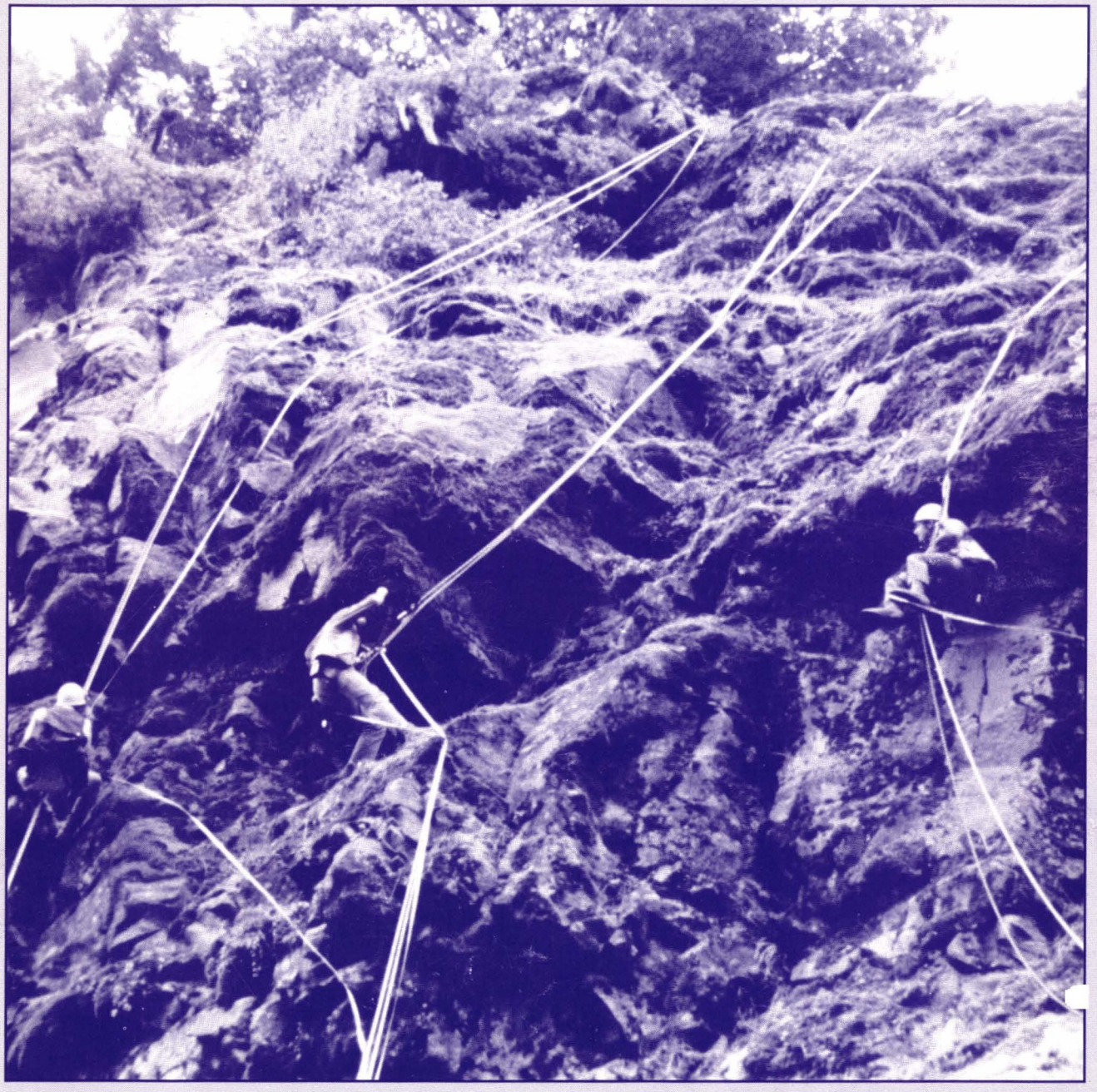
September 1996



A report for land managers on recent developments in forestry research at the four western Experiment Stations of the Forest Service, U.S. Department of Agriculture

Forestry Research West

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Cover

It may look like a human spider web, but these researchers from the Intermountain Research Station are studying slope stability. Read about it on page 1.

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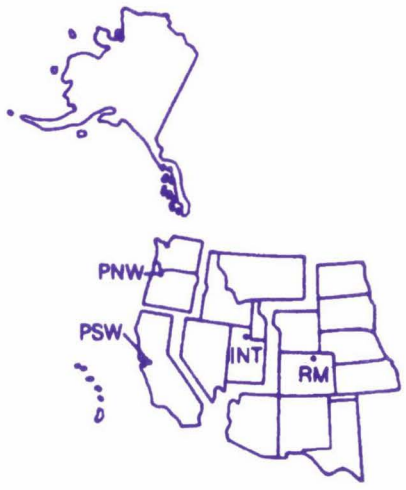


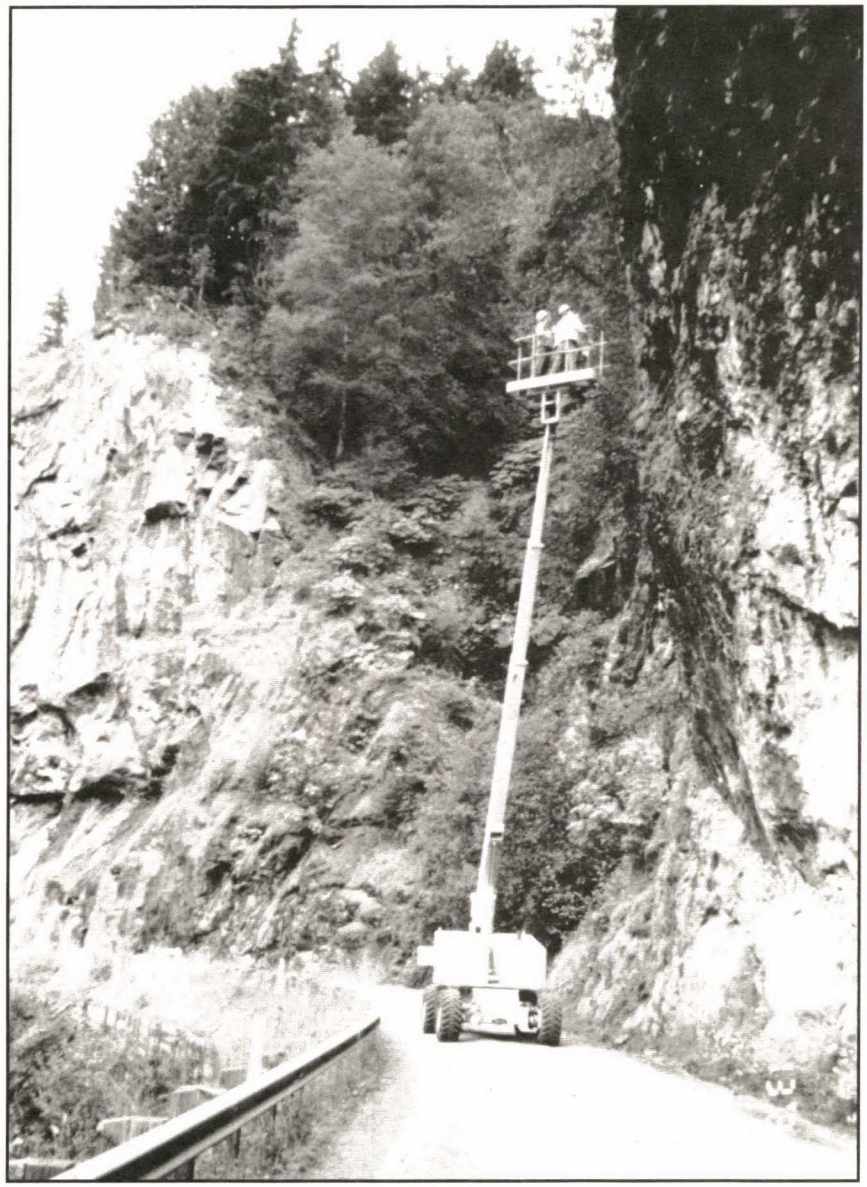
Slope stability: more is less

by David Tippets
Intermountain Station

Three volumes, each the size of a city telephone directory, provide a reference to just about anything you want to know about keeping mountainsides from coming unglued when designing roads or timber sales. The mass of information looks intimidating at first, but the "guide to the guide" in the first volume quickly reveals the material is organized and identified in sections written for different kinds of professionals. Land managers have a portion prepared specially for them and aren't expected to digest the same level of technical detail as geotechnical engineers.

More than anything, however, the three volumes are intended as a practical guide for geologists and engineers who are trying to answer often difficult questions about slope stability. For them, the guide can be used as both a textbook and a laboratory workbook with practical problems. Those who use it as such can learn the theories and concepts behind slope stability analysis.

The work teaches the three-level analysis process and how it can fit into integrated resource planning. The compilers have mapped a route to follow in meeting NEPA requirements for stability analysis and complying with the law while providing technical expertise to forest plans. The direction for practical application of technical material was facilitated by teaming up a long list of Forest and Regional geotechnical engineers with research geotechnical engineers Rod Prellwitz and Tom Koler from the Intermountain Research Station. The Forest Service's Washington Office Engineering Staff published the three volumes identified as EM-7170-13.



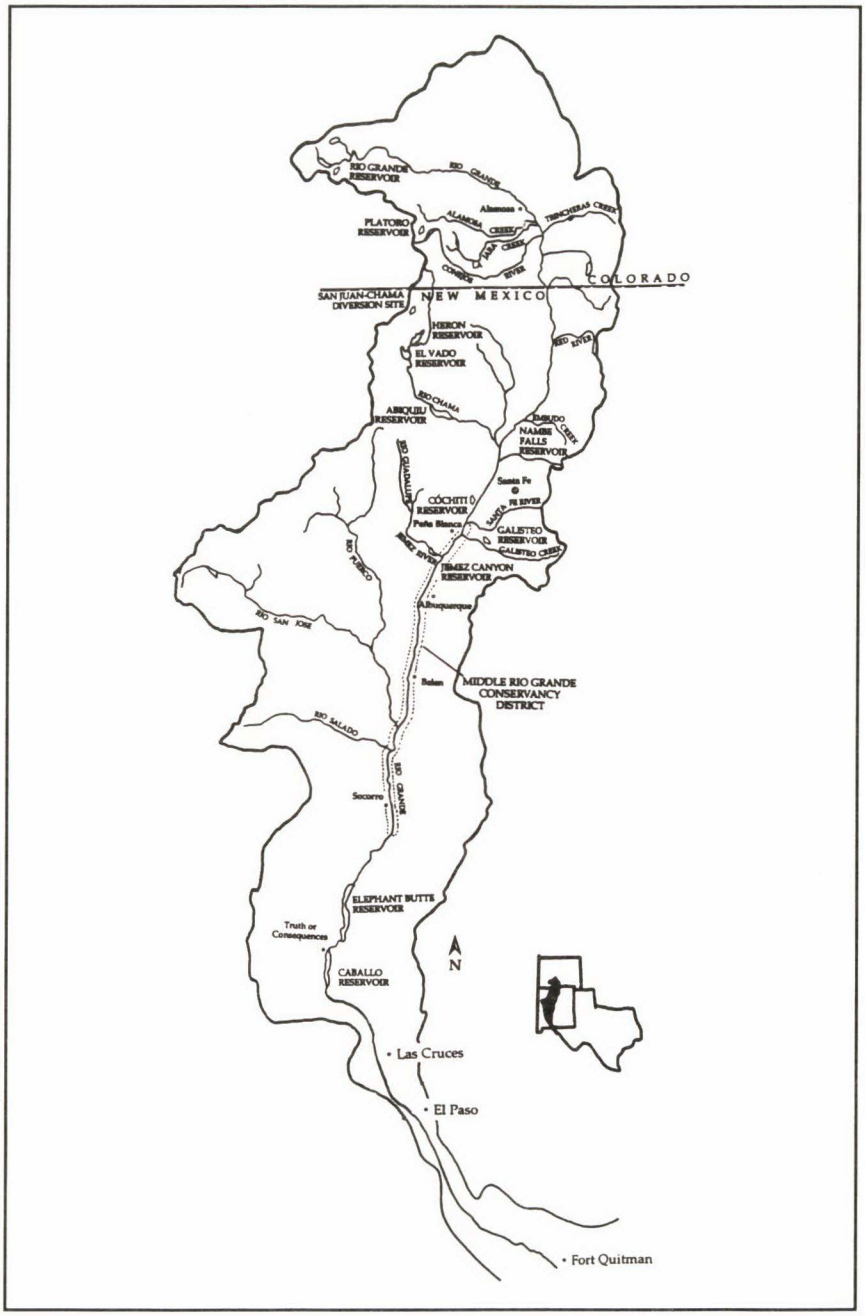
Slope stability analysis in the Pacific Northwest.

Research in the Middle Rio Grande Basin

by Deborah Finch
and Rick Fletcher
Rocky Mountain Station

The Middle Rio Grande Basin of New Mexico, frequently defined as the area between Santa Fe and Socorro, encompasses numerous land ownership boundaries, vegetation types, desert and woodland ecotones and edges and urban and rural cultures, forming a complex array of interactive ecological systems. Historically known as the Southwest's "River of Life," the Rio Grande has lately become a subject of controversy over water resources and biological diversity. Human dependency on its waters, lands and biotic resources reflects the traditions, economies and social values of Hispanic, Anglo and American Indian cultures. Sustainability of the Rio Grande's socioeconomic and ecological systems is a goal that has united diverse institutions, agencies, scientists and private groups throughout the Southwest. This has resulted in numerous partnerships and initiatives designed to conserve the river and its way of life.

Scientists with the Rocky Mountain Station's Forestry Sciences Lab in Albuquerque, NM, have initiated a program to develop, synthesize and apply new knowledge on processes, interactions and sociocultural uses of upland and riparian ecological systems for sustaining diverse productive and healthy plant, animal and human populations and associated natural resources in the Middle Rio Grande Basin.



The Rio Grande Basin in Colorado, New Mexico, and Northern Texas, including the Middle Rio Grande study area from Cochiti to Elephant Butte.

Studies are addressing four problem areas:

- short-term and long-term responses of upland soils, water, nutrients, belowground systems and vegetation to historic and current perturbations caused by factors such as climate, grazing and fire, including interpretation of how such responses influence dynamics, stability, and productivity of upland ecosystems;
- processes within fluvial ecosystems that form major linkages between upland catchments, the Rio Grande and its floodplain bosques;
- responses of plant, fish and wildlife species to barriers in dispersal, migration and reproduction along the Rio Grande and selected tributaries; and
- improving understanding of the environmental history of the Rio Grande Basin, the historic and contemporary human role in Basin ecosystems, the nature and extent of anthropogenic disturbances to the Basin, and the sustainability of cultural diversity in the Basin.

Ecology and restoration of upland basin rangelands

Project Leader Deborah Finch explains that successful restoration of grassland ecosystems that have been damaged by disturbances such as historic overgrazing, drought, fire exclusion, road-building or recreation, often involve intervention with treatments that will interrupt the desertification process and re-establish natural ecological processes. Current studies are assessing responses of soil nutrients, water, belowground ecosystems and herbaceous plants to restoration treatments.

Studies are also underway on the restoration benefits of prescribed fire and/or thinning of woody plants in blue grama grasslands, transition zones, and pinyon-juniper woodlands that are either protected from grazing, or heavily grazed and showing signs of stress.

Rangeland/woodland ecotonal responses to climate change

Studies of effects of climate change on pinyon-juniper woodlands and associated ecotones are underway. Scientists are assessing demography and condition of pinyon by analyzing tree rings and then relating age structure, mortality and recruitment rates to historical climate change. A study, in cooperation with the University of New Mexico, is evaluating boundary shifts in pinyon-juniper woodlands at landscape and regional scales in response to historic climate change. Study results will provide information on factors contributing to woodland invasion and recession at the local and landscape levels. Such information is essential for interpreting condition and health of pinyon-juniper woodlands.

Research natural areas in the Middle Rio Grande Basin

On the Santa Fe National Forest, researchers are evaluating age structure and density of an old-growth ponderosa pine forest in relation to changes in fire regime and climate fluctuations. Study results show that forest age structure is distinctively multi-modal with a remnant overstory of older trees (>300 yrs) that are dead or dying. The understory is dominated by very dense pole stands. Scientists have learned that changes in stand structure are correlated with changes in fire regime. Results also suggest that high density in the understory may have negative impacts on nutrient cycling and moisture competition, which are increasing the rate of overstory mortality, leading to a different kind of old-growth forest than would have been expected under pre-settlement conditions.

Species of concern in upland woodlands

During the summers of 1995 and 1996, scientists examined

species composition, abundance and maternity roost requirements of sensitive bats captured in the Rio Grande Basin. Radio transmitters were attached to individual bat species to locate roost sites. Colony size varied from 30 to 200 maternal bats per roost. Further results have been published via technical reports or poster presentations.

Watershed analysis and stream quality

Scientists are studying water and stream quality, nutrient dynamics and vegetative cover in the Rio Puerco Watershed. It is a major tributary of the Rio Grande and one that scientists and managers concur has been heavily damaged by historic livestock grazing. Scientists are also working on spatial relationships among lightning, precipitation and vegetative cover within the watershed .

To test the hypothesis that areas receiving equivalent amounts of precipitation during the monsoon season have similar vegetation responses, remotely-sensed lightning data are being compiled and analyzed. Final products will include GIS thematic maps of the area that display precipitation and vegetative cover, and also precipitation contour maps.

Another study looks at the relationships between subsurface geomorphic features and the locations of riparian and wetland ecosystems along forest roads, and evaluates the effects of road modification and construction activities planned for these roads. Investigations will be able to assess present conditions, make recommendations to the road engineers and then monitor road construction and other modifications.

Stopover ecology of neotropical migratory birds

The Rio Grande is an important flyway for neotropical migratory birds, but its "bosque" has changed greatly over the past 100 years, owing to exotic woody plant invasions, dams and diversion structures, urban expansion, water pollution, irrigation practices, agricultural conversions and flood control. Researchers are reviewing the research needs for the bosque habitats, including habitat relationships of birds and anthropods. "Our bird migration study assesses use and availability of stopover habitat for neotropical migratory landbirds during their north-south migration," says Project Leader Deborah Finch. Birds were captured in mist nets, measured, banded, and released in the spring and fall at the Bosque del Apache Wildlife Refuge and the Rio Grande Nature Center, near Albuquerque. Research findings will be used to define methods, localities and benefits to restoring migratory songbird habitats.

Cowbirds and the Southwestern Willow Flycatcher

The Southwestern Willow Flycatcher is federally listed as endangered. Declines in its population are associated with loss and conversion of its habitat, and cowbird parasitism. Federal and state agencies have already advocated cowbird control measures. To provide a scientific basis for flycatcher recovery in relation to cowbirds, a comprehensive literature review was done to assess the relationships between cowbird, hosts and riparian habitat use. Field studies are evaluating stopover habitat use, and use of exotic salt cedar and native willow by migrating flycatchers.

Fish species of concern

Studies are underway to update the current knowledge on the distribution of the Rio Grande cutthroat trout, a sensitive species formerly abundant in the headwaters of the Rio Grande in Colorado and New Mexico, and its co-occurrence with two native cyprinids, the Rio Grande sucker, a fish listed by the State of Colorado, and the Rio Grande chub. Future objectives are aimed at identifying the role of

physical and biological factors in fragmenting the distributions of these fish.

Human dimensions: environmental history

Studies are underway on the impacts of humans on the Middle Basin over the past 450 years. Various land uses, such as grazing, irrigation, logging and construction of flood control features, combined with climatic fluctuations, have produced changes in stream flow morphology, ground water levels, topsoils, biotic communities and individual plant and animal species. Indigenous human populations have been affected by these modifications also. Continued land-water use impacts from a rapidly increasing regional population suggest ongoing changes and major challenges for natural and human resource management organizations. An environmental history has been published that describes land use and change during American Indian, Spanish Colonial, Mexican Territorial and Statehood periods.

Human ecology and cultural resources

Available technology and levels of technological knowledge have profoundly influenced human-generated impacts in both riparian and upland ecosystems. Understanding these impacts includes evaluation and analysis of the influence of intensive irrigation agriculture introduced by the Spanish in the seventeenth century, and the impacts of introduced domesticated plants and animals, especially cattle and sheep.

Scientists are also develop 3-dimensional GIS models of reconstructed past landscapes by using archaeological, vegetation and paleoenvironmental data from the Santa Fe National Forest.

New from research

Just show me

Members of the Northern Alliance, a partnership between the Forest Service, Utah State University and the University of Idaho, recognized that the most powerful teaching tool they had was the ability to take people to where they could actually see examples of natural resource management. The experimental forests, ranges, and watersheds provide excellent outdoor teaching laboratories.

As a first step in establishing these areas as learning centers, Wyman Schmidt and Judy Friede of the Bozeman Forestry Sciences Laboratory compiled a compendium of all the special experimental areas in the Northern Rockies. The compendium includes maps and examples of the unique learning opportunities that exist for each area.

For those who must see it to believe it, these areas offer the opportunity for enlightenment.

Request *Experimental Forests, Ranges, and Watersheds in the Northern Rocky Mountains: A Compendium of Outdoor Laboratories in Utah, Idaho, and Montana,* General Technical Report INT-GTR-334, from the Intermountain Research Station.

Economic indicator maps

In response to the National Forest-Dependent Rural

Communities Economic Diversification Act and to the expanded role of the Forest Service rural development, economic researchers assembled indicator maps and basic economic data for Continental United States.

The Intermountain Research Station published the information by geographical area in three reports. If you'd like copies of the reports, order from the Intermountain Station:

Economic Indicator Maps for Rural Development in the Interior West, General Technical Report INT-330.

Economic Indicator Maps for Rural Development in the Pacific West, General Technical Report, INT-328.

Economic Indicator Maps for Rural Development in the East, General Technical Report INT-329.

Disturbance ecology

Current knowledge about disturbance ecology suggests that it's time for a paradigm shift to a broader approach in natural resource management. Although managers have traditionally looked at ecological disturbance from a negative perspective, ecologist are discovering that those disturbances are natural processes in healthy dynamic ecosystems.

Insects, wind, fire, and flood all played a role in shaping our landscape. The forces of nature sometimes seem catastrophic and destructive, but for managers aspiring to implement ecosystem management these natural processes need to be put in their ecological context.

As a help to managers and scientists wanting to get a fresh perspective on ecological disturbance processes, Ecologist Paul Rogers collaborated with the Intermountain Center for Research on Disturbance Ecology to review the literature and highlight it. To obtain a copy of those highlights request *Disturbance Ecology and Forest Management: a Review of the Literature,* General Technical Report, INT-336, from the Intermountain Research Station.

Survey methods for detecting American Marten, Fisher, Lynx, and Wolverine

The status of the American marten (*Martes americana*), fisher (*Martes pennanti*), lynx (*Lynx canadensis*), and wolverine (*Gulo gulo*) is of increasing concern because, in this century, these species no longer occur throughout much of their historic range in the western United States. Habitat loss through timber harvest and residential development, increased roading of forests, and these species' susceptibility to trapping and general sensitivity to human disturbance have been implicated in the decline of one or more of them. One of the most sensitive measure of the integrity of natural ecosystems is whether populations of tertiary consumers, like these four species, occur in an area and can be sustained there. Therefore, assessing the presence of these species is an essential part of determining the health of forest ecosystems.

Because these species are protected throughout much of their range in the western United States, information on population status and trends is unavailable from trapping records. This report describes methods for detecting the four species—using either remote photography, track plates, or snow tracking—and provides a strategy for systematic sampling and advice on the number of devices used, their deployment, and the deployment, and the minimum sampling duration for each sampling unit. A method for disposing of survey data is recommend such that the collective results of multiple surveys can describe regional distribution patterns over time. The report not only describes survey methods for detection but also provides some considerations for their use in monitoring population change.

Request *American Marten, Fisher, Lynx, and Wolverine:*

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2) *Partnerships for Sustainable Forest Ecosystem Management*, General Technical Report RM-266

3) *The Santa Rita Experimental Range: History and Annotated Bibliography (1903–1988)*, General Technical Report RM-276

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1) *American Marten, Fisher, Lynx, and Wolverine: Survey Methods for their Detection*, General Technical Report PSW-157

2) *The Biswell Symposium: Fire Issues and Solutions in Urban Interface and Wildland Ecosystems*, General Technical Report PSW-158

3) *Proceedings of the Second Symposium on Social Aspects and Recreation Research*, General Technical Report PSW-156

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Survey Methods for Their Detection, General Technical Report PSW-157, from the Pacific Southwest Research Station (at its distribution center at Fort Collins, Colorado.)

The Santa Rita: a legacy to behold

The Santa Rita Experimental Range, founded in 1903, is the oldest research area maintained by the Forest Service. It has been a principal site for pioneer range research on the improvement and management of semiarid grasslands in the Southwest. The Range is viewed as a world-class facility because of the long-term historical and biological data bases that have been maintained since its creation. The history of the Range, research, environmental descriptions and a discussion on vegetational changes are provided in the report *The Santa Rita Experimental Range: History and Annotated Bibliography (1903–1988).* Copies of General Technical Report RM-276 are available from the Rocky Mountain Station.

Fire in urban interface and wildland ecosystems

The focal point of the Biswell Symposium: Fire Issues and Solutions in Urban Interface and Wildland Ecosystems (help February 15-17, 1994) was the 1991 "Tunnel Fire" in the Oakland/Berkeley Hills in northern California; however, the issues and solutions are regional and national in scope.

Key issues included social barriers, fire safety, fuel management, legal barriers, multiple jurisdictions, program cost and benefits, wildland health, conflicts between wildland resources and residential structures, air quality, and liability.

Researchers have identified social barriers that hinder adoption of fire-safe practices by the general public. The public has been educated about the losses associated with catastrophic wildfires. Legal solutions in California and Florida address liability issues in fuel management and fire hazard reduction. Community and neighborhood associations have been formed to promote fire-safe wildland-urban interfaces. Interagency agreements have been developed to apply prescribed fire at ecosystem levels for mutual benefit. Environmentally safe fire-suppression techniques have also been developed.

Request *The Biswell Symposium: Fire Issues and Solutions in Urban Interface and Wildland Ecosystems*, General Technical Report PSW-158, from the Pacific Southwest Research Station (at its distribution center at Fort Collins, Colorado).

Social aspects and recreation research

Examination of natural resources often leaves out one important component—the human element. To enable resource managers and researchers to exchange information and ideas about the human dimensions of natural resources, the second Symposium on Social Aspects and Recreation Research was held February 23-25, 1994, in San Diego, California. The proceedings of this symposium contain abbreviated versions of 29 oral presentations, and summaries of sessions covering poster presentations, simulated field trips, and round-table discussions. Issues addressed included conflicts, ecosystem management, multicultural groups, land ethics, protection and safety, partnership and service delivery, pilot project and new paradigms, economic issues and resource management case studies.

Request *Proceedings of the Second Symposium on Social Aspects and Recreation Research*, General Technical Report PSW-156, from the Pacific Southwest Research Station (at its distribution center at Fort Collins, Colorado).

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